Use of Occupational Ethnography and Social Marketing Strategies to Develop a Safety Awareness Campaign for Coal Miners

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Abstract

Underground mining, like many high-risk industries, is facing a crisis in the near future. This industry has traditionally relied on a master–apprentice relationship to train new workers, but experienced miners are retiring in large numbers, leaving few "masters" to properly train their replacements. With a recent resurgence in mining, many new miners are entering the workforce each day. The rise in the number of inexperienced workers has implications for worker safety in an industry in which one mistake can blow up the entire workplace. The explosion in the Darby Mine in May 2006 that killed five miners illustrates what can happen in hazardous environments such as underground mines.

The Health Communications Team at the National Institute for Occupational Safety and Health Spokane Research Laboratory was asked to address this problem by developing new training and safety awareness materials to promote safe flame cutting and welding practices. This article describes how occupational ethnographic techniques provided insights needed for "new product development." The result of this work was a national initiative to raise awareness and to protect underground coal miners from the dangers of flame cutting and welding in an environment filled with solid fuel and methane (natural gas). Although this project was initially designed for the mining industry, the approach and lessons learned are applicable to any high-risk industry and should be of interest to other social marketing or occupational safety and health professionals.

Introduction

Mining is considered a "high-risk" industry. In the past two years, there have been several high-profile disasters that claimed the lives of miners and convinced Congress to strengthen regulations concerning mining health and safety. The mining industry has dramatically improved its safety record since the early 1900s, when records, although incomplete at best, showed that over 4,000 miners died every year. In 2007, according to the Mine Safety and Health Administration (MSHA), 64 miners died. While a remarkable improvement, this is still an unacceptable loss of life (MSHA 2006).

Mining is one of the few U.S. industries that requires safety and health training, with Codes of Federal Regulation (30 CFR Parts 46 and 48) mandating both "New Miner" training and "Annual Refresher Training" for every miner. (In this article, the authors use "training" to mean "safety and health practices" rather than skills or job training.) With large numbers of experienced miners leaving the industry (Baby Boomers that started mining in the 1960s and 1970s), it is crucial that *effective* training be developed to train a new generation of miners before the experts leave. Developing effective training for this industry, however, is a challenge. This article describes the mixed-methods techniques used in the formative research and pretesting used to design training materials and strategies for this unique occupational group.

The year 2006 was particularly deadly for the U.S. coal mining industry. Three separate disasters claimed multiple lives, beginning with the Sago Disaster on January 2 and followed closely by the Alma Mine Fire on January 19. On May 20, the Darby Mine in Holmes Mill, Kentucky, exploded when an explosive mixture of methane came in contact with either the flame from a cutting torch or hot metal from the cutting operation. Five miners died that night.

In response to these disasters, the National Institute for Occupational Safety and Health (NIOSH) was directed by Congress to develop a training intervention for the coal mining industry that would promote safe flame cutting and/or welding techniques to repair or maintain equipment underground. Flame cutting and welding are especially dangerous in coal mines because methane often leaks from the coal seam, causing a potential for explosions if levels exceed certain limits.

The Health Communications (HC) team at the NIOSH Spokane Research Laboratory (SRL) was charged with the task of designing a safety awareness program to teach and remind miners of safe cutting and welding practices. The project was to be national in scope, and relevant to new or experienced miners working in mines of varying size and production methods. The team was given less than seven months to complete this task.

Whereas the team had a great deal of experience developing training materials for non-coal miners, with nine training videos and numerous publications to their credit (Cullen and Fein 2005), only the team leader had any experience in the underground coal industry. This posed a special challenge to the team, as mining fits the definition of an "occupational culture." These cultures can be identified as, "a group of people who consider themselves to be engaged in the same sort of work; whose identity is drawn from the work; who share with one another a set of values, norms and perspectives" (Van Maanen and Barley 1984, 287). Strong occupational cultures can be very resistant to outsiders, especially outsiders who try to tell workers what to do and how to do it. Training is often perceived in this manner by workers, especially when the material is presented by someone who is obviously not a member of the occupational culture. Thus, to develop training that would be effective for every type of mine in this segment of the mining industry, it was necessary for the research team to understand the history of the problem and the culture of coal miners throughout the nation.

Theoretical Frameworks

Two overarching conceptual or theoretical frameworks – occupational culture and the SRL Occupational Safety Intervention Cycle – guided research. Adult learning practices were also employed in developing the training materials.

Occupational culture

The dominant framework used by the research team was the concept of *occupational culture*. Culture is described by Arnould and Wallendorf as "the cumulative total of learned beliefs, values, and customs that serve to order, guide and direct the behavior of members in a particular society or group. Culture can be thought of as that which one needs to know to behave in a manner acceptable to its members" (1994, 485).

In hazardous occupations, such as coal mining, culture is especially important in creating a sense of camaraderie and clear boundaries with outsiders. Van Maanen and Barley (1984, 301), explained:

> *Danger . . . invites work involvement and a sense of fraternity . . . . Recognition that one's work entails danger heightens the contrast between one's own work and the work of others, and encourages comparison of self with those who share one's work situation. Attitudes, behaviors, and self-images for coping physically and psychologically with threat become part of an occupational role appreciated best, it is thought, only by one's fellow workers.*

An occupation's culture has important implications for behavior change interventions. Hansen (1995) suggested that new information (such as training)

provided to people will always be filtered through the experiences and norms of their occupational culture, and if seen as incongruent, will most likely be disregarded. In order for training to be effective, the program must find ways to make the safety practices it promotes compatible with the existing culture and attractive to its members. It also is important to identify people to serve as credible spokespersons. The hazardous nature of the work increases the distrust miners have of outsiders who lack the personal experience needed to understand their situation and the special demands miners face. As a result, credible insiders make the most effective role models, opinion makers, and change agents. Hassan and his associates (2007, 18) noted: "Sources exhibiting expertise and trustworthiness are more effective in changing opinions.... If messages are attributed to low-credence sources, they are less likely to affect behavioral change." Cannon and Sheth (1994) also acknowledged the importance of building trusting relationships, and although their work focuses on more traditional marketing, social marketing has much to gain by recognizing the power credible peers have to influence behavior.

SRL occupational safety intervention cycle

The SRL Occupational Safety Intervention Cycle is a theoretical intervention model that combines both the Centers for Disease Control and Prevention (CDC)

FIGURE 1

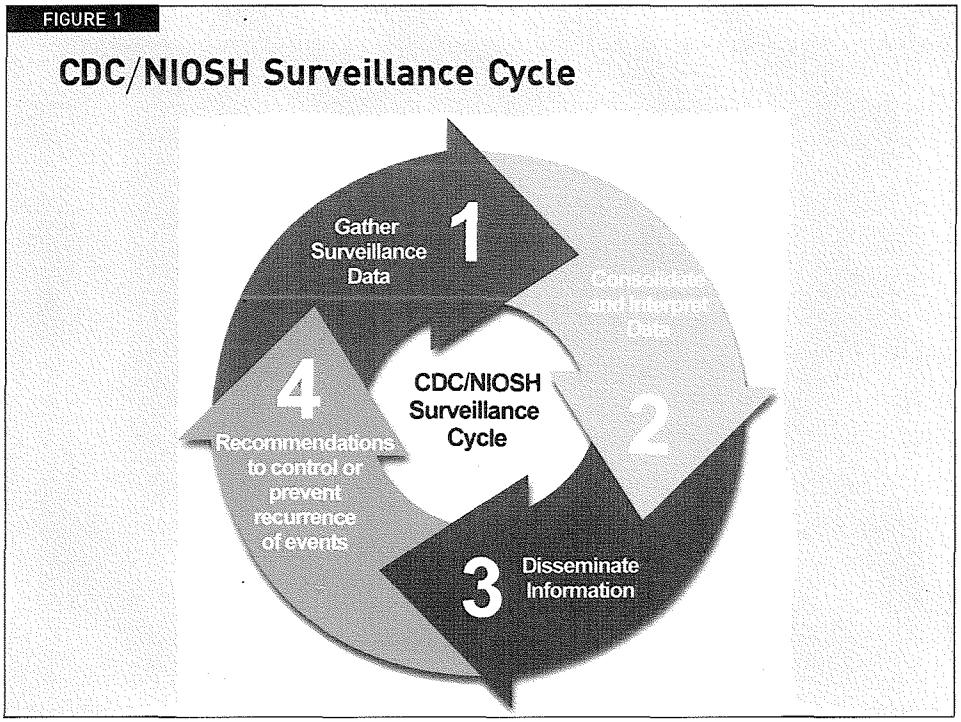
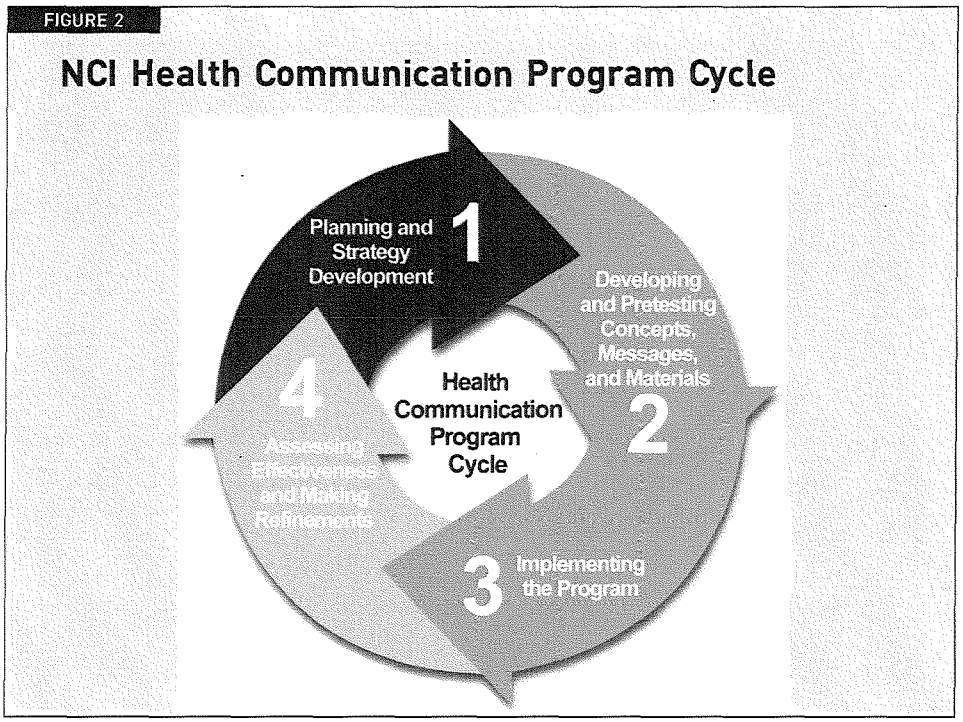


FIGURE 2



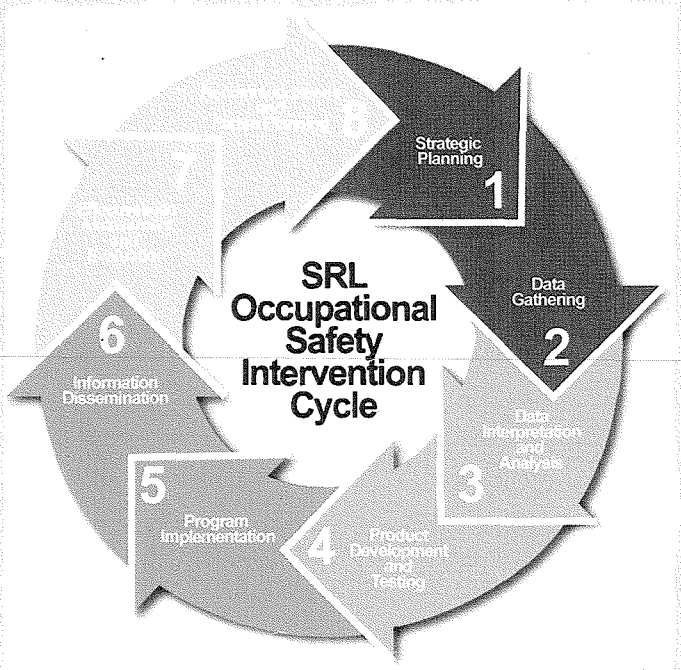
Surveillance Cycle (Figure 1) and the National Cancer Institutes' (NCI) Health Communication Program Cycle (National Cancer Institute 2003) (Figure 2). This hybrid model incorporates the rigor of the CDC Surveillance Cycle and the success of the NCI's health communication process. The resulting eight-step process is cumulative, with each step building on the previous one (Figure 3).

Learning theories

The research team used various learning theories to provide both a base and direction for developing products to promote safety awareness among miners. The most obvious characteristic of miners is that they are adults. In fact, U.S. law prohibits anyone under the age of 18 from working in a mine. Therefore, it was important to base the new training products for miners on assumptions of adult learning theory as defined by Knowles, Holton, and Swanson (1998). Effective training for coal miners, according to Knowles et al., is based on real-life experiences and is relevant and applicable to their work experiences. Wlodowski (1985) suggested that training is more effective when the trainees believe they will be successful in learning and that the training is valuable to them. Clearly, it was necessary for the training development team to discover what life experiences were important to coal miners and what types of things they valued.

FIGURE 3

SRL Occupational Safety Intervention Cycle



Research Methods

A purposive sample was selected to ensure that the research team understood differences among underground coal mines across the nation. Nine active mines were selected to provide variation on the following attributes:

- Small mines and large mines (small defined as fewer than 20 employees);
- Eastern mines and western mines;
- Union operations and non-union mines;
- Experienced workforces and inexperienced workforces (less than one year);
- Contractors and mine employees;
- Low-seam and high-seam mines;
- Traditional "room-and-pillar" compared to "longwall" production method; and
- Regional and/or state variations.

Seven mines were selected from the eastern coalfield states of Virginia, Pennsylvania, and Kentucky, and two western mines were selected from Wyoming

and Colorado. The two western mines were large, with 300–600 employees, and both were longwall operations, although both used room-and-pillar mining to develop new sections for mining. None of the eastern mines used a longwall mining method. Both of the western mines were mining high seams of coal, between 8 and 12 feet thick. Two of the mines visited were in eastern Kentucky, and one in western Kentucky. Each of these mined coal seams less than 60 inches and one mine averaged approximately 39 inches. This mine was also the smallest in the study, with only six employees.

The goal of this project was to develop new safety awareness products for underground coal mining. Hill and Hill (2007, 1099) discussed new product or service development (NPD) and suggested that it is the accumulation of knowledge from different sources, using a snowball method, that strengthens the development of new products. They also stated that the traditional, linear approach to NPD may impede the successful interaction and collaboration with the targeted audience, and that "concurrent engineering" where "activities such as strategic planning, concept generation, and technical development . . . occur concurrently" may be a better model.

Data collection

The HC team at SRL began the research by reviewing existing data to gain insight into the problem, and continued by visiting the mines to observe operations and to conduct interviews. The team included seven people, with five available to do field research. An eighth researcher from the NIOSH office in Pittsburgh who had extensive experience with coal mining joined the team as a technical advisor.

A mixed-methods research approach was selected because the research team had relatively little experience with the coal mining industry and realized that the project's success required a thorough understanding of the cultural context in which flame cutting and welding occurs. In addition to relevant quantitative data on injuries and types of incidents related to cutting and welding, it was necessary to collect qualitative data to understand the motivational drivers and cultural barriers affecting safety issues related to these tasks. Informal and semi-structured interviews were conducted in natural settings. The research team collected data from the safety trainer or safety manager at each mine. In addition, data were collected in the natural setting of a miner – underground during normal work shifts.

Miners and safety trainers were asked questions about preferred training tools and methods of training. The research team quickly learned of the common need for updated safety videos to meet federal safety mandates regarding training. In

addition, the miners and safety trainers indicated the utility of training materials that could be taken underground. Examples included posters to hang in their underground "lunchrooms" and stickers which are regularly used as currency among miners. The team also noted differences between small and large mines in access to training rooms or technology that would allow multimedia formats for training materials. Smaller mines had no way to use higher-tech products, relying instead on such formats as "tool-box talks" that could be provided before or during shifts while miners simply gathered around. As the research team's charge was to develop a *national* initiative, it became clear that the resulting product would need to include a variety of products to accommodate differing environments. Field notes based on data and researchers' observations were collected during this process.

Time constraints made it necessary to divide the research team into smaller groups so collection of data in different mines could overlap. Generally, field teams were made up of three people, only one of whom had experience in coal mining. Creating smaller research teams also made it easier to gain entry into mines that had few workers. Hill and Hill (2007) in their discussion of NPD affirmed the utility of using a more flexible approach to data gathering. They described their research experience using different sub-groups operating semi-autonomously under the direction of the Project Manager. This mirrored the approach used by the SRL research team, which allowed the gathering of a large amount of data in a relatively short period of time.

Quantitative data

Researchers benefit from the fact that the U.S. mining industry has one of the most comprehensive accident and injury databases in the world. MSHA gathers data on accidents, injuries, and fatalities in all sectors of the mining industry. This database dates back to 1975 when the Mine Safety Act began requiring all mines to report every accident or injury.

To understand the scope of the occupational safety issues surrounding flame cutting and welding in underground coalmines, the HC team conducted a detailed analysis of all injuries and fatalities attributed to flame cutting and welding, as well as explosions and fires between January 1983 and April 2006. The records showed that in that time period there were 786 injuries and fatalities attributed to flame cutting and welding and 2,448 injuries and fatalities from fires and explosions (MSHA 2002). While the severity of injuries in both categories are hard to classify without medical records, the data do indicate which specific areas of the body were injured, giving researchers a measure of guidance while developing questions for their occupational ethnography.

A preliminary list of accidents and injuries attributable to flame cutting and welding was compiled by team members, who then identified categories of injuries and activities at the time of the accidents. From this list, information was gleaned about which job categories were most likely to be involved in this type of accident as well as the set of pertinent regulations concerning cutting and welding.

In addition to MSHA injury and fatality records, the HC team also reviewed relevant sections of the CFR to ensure that any new product developed by the team would be accurate, both culturally and legally. The federal safety regulations provide the minimum requirements for conducting safe operations at a mine site. Often, however, local conditions require special measures to ensure the safety of the workers either through additional ground control, increased monitoring of the mine atmosphere, or specialized remote operated equipment. Mines develop policies and procedures in response to their own unique environments that are often more stringent than federal standards. The CFR served as a guide for the researchers to develop safety awareness materials, while the specialized and site-specific techniques were used as examples of best practices or novel approaches to be shared with other mines. Information on the additional safety measures was gathered throughout the course of the research project.

Occupational ethnography

Consistent with social marketing's consumer orientation (Grier and Bryant 2005), the research team recognized the importance of viewing behavior through the eyes of the workers they hoped to change. Ethnography is an immersive field research technique that places the researcher in direct contact with consumers and provides firsthand experience with the social or cultural milieu in which the consumers live and work (Hansen 1995). For the SRL research team, this approach was ideal for studying the underground coal mining workplace culture. Drawing on ethnographic techniques recommended by Arnould and Wallendorf (1994), the formative research was designed to (1) collect data in the natural setting of the culture; (2) give researchers intensive participation in workplace culture; (3) allow researchers to interpret behaviors in a way that the culture finds credible; and (4) use multiple methods to gather data in order to generate a range of perspectives on the behaviors under observation.

Although each of these techniques was used by the HC research team during the ethnographic phase of the formative research, the project's short timeframe made it impossible to spend the amount of time usually devoted to a conventional ethnographic study. In addition, the need to understand varied coal mining environments required the team to conduct research in as many mines as possible

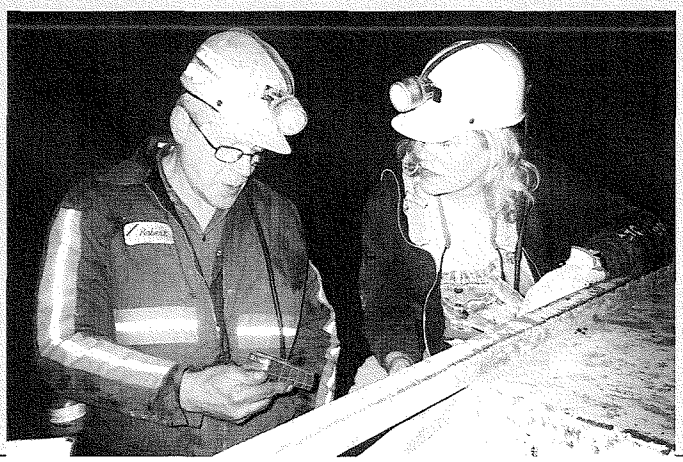
across the country. To meet these demands, a rapid ethnographic assessment or occupational culture scan was designed that could be completed in just a few months. Beebe's (2001) Rapid Assessment Process (RAP) was selected because it provided guidance for collecting data in six weeks or less and maximizing understanding by analyzing the data in an iterative fashion.

A combination of interviews, observations, field notes, informal conversations, photography, videography, and questionnaires were used to gain understanding of the coal mining culture and safety issues related to flame cutting and welding underground. At each mine, a safety official or trainer served as a tour guide and escorted the HC research team underground to gain a first-hand understanding of coal mining (Figure 4). The team gathered the following types of information at each mine visited:

1. Mine name, company, and mining method;
2. Location of mine and size of workforce;
3. Union affiliation (if any);
4. Contractors (if any);
5. Rough percentage of new hires (miners with less than one year experience);
6. Training practices;

FIGURE 4

Dr. Elaine Cullen Conducting an Interview with a Coal Miner in Kentucky as Part of the Occupational Ethnography



7. Training preferences regarding trainers, training formats, training materials and facilities;
8. Common beliefs and perceptions about methane/fires/explosions;
9. Workers' perceptions of the cutting and welding processes and which people do these tasks;
10. Best practices or mine policies;
11. Attributes of role models and trusted spokespersons;
12. Experience with fire/explosion/flame cutting accidents; and
13. Knowledge and perceptions of the Darby Mine disaster.

Although these thirteen categories of information were used as a starting point, researchers encouraged participants to talk at length about the topics and probed for any additional information in an informal manner. Beebe (2001, 41) explained, "The goal of RAP is to have people tell their stories and not to have them answer your questions."

Data analysis

After the ethnographic field studies were completed, team members met to analyze the qualitative data. Thematic analysis was used to identify themes and topics that could guide the next phase of the project. Because no member of the team visited every mine in the study, the field visits were thoroughly discussed by the group, allowing each person to share experiences and perceptions. Individual mines were compared and contrasted, looking for common themes, as well as those that were either unique or regionally based. The group data analysis process (directed by the rapid assessement method) assisted the team in identifying topics that were most common to each mine. These areas informed the research team about what would be the most appropriate focus based on consumer needs. The following categories were determined to be most relevant to miners' needs for new training products:

- Hazard identification and reduction;
- Site preparation, execution, and clean up;
- Personal safety; and
- Best practices.

Product development tasks were then assigned to SRL team members based on prior experience and areas of interest and expertise. With only seven team members to share the work, each person was assigned a number of tasks to

complete with the help of other team members. (The eighth member acted as a technical advisor for material development.) The team continued to apply RAP data analysis techniques during the development of training materials, particularly as ideas were brainstormed, designs considered, information gathered, and new products began to take shape.

Formative Research Findings

The mining industry went through a depressed economic cycle that lasted most of the 1980s and 1990s. As a result, few workers were hired during this time, and many workers lost their jobs. The industry saw a resurgence beginning in the early 2000s and high prices for commodities led to a dramatic increase in the number of mines opened and the need for more workers. The demographics of the mining workforce in 2007 showed that the age and experience levels were distributed bi-modally, with either very experienced or very inexperienced workers, but almost no workers' experience levels falling in between. Overall, the proportion of new and inexperienced employees working in the mines was larger than expected. In one large mine, for example, several work crews had no one with more than one year of experience.

In training new workers, miners, like many skilled blue-collar industrial workers, rely on a "master–apprentice" relationship. Mining is not learned in a classroom; one learns to be a good miner by working with a good miner, and by doing what he does. Learning is part of the miners' social life, with new miners watching others and doing what they do or avoiding practices that are deemed "unacceptable" based on occupational norms. It is also important to note that while mining may be learned "on the job," federal and state law requires that miners learn *safety* in a classroom from a certified instructor. In an attempt to address the needs of both new and experienced miners, materials typically fall into two categories: introduction to hazards and safety awareness ("new miner training"), and reminders of best practices ("refresher training").

Miners take tremendous pride in their mining skills and their capacity for exceptionally hard work. Based on the extensive work in this field by the lead researchers (Cullen and Fein 2005), the following values are important to acknowledge in examining the mining industry and culture and also to remember as products are developed:

- The ability to do hard work and be productive is respected.
- Miners are special; not everyone has what it takes to be a miner.
- Miners are macho; although there are a few women in the industry, this is a male-dominated culture.

These values are reflected in the term used to describe miners they respect: "Coal Hog." This example of "tribal language" (Hansen 1995) refers to the view that good miners are "hungry for coal" and can never mine enough.

Miners also hold a value for safety and the knowledge and skills needed to do their work effectively. The ability to keep themselves and fellow workers safe is important but is also balanced with a desire to work quickly and efficiently.

Miners place a high value on hard-hat stickers. These stickers may be mini-advertisements for vendors or products, show that a person is a member of a particular work group, celebrate a particular level of accomplishment, or remind workers to work safely. They also provide necessary reflective material for underground workers to increase the likelihood they will be seen by operators of moving equipment. Stickers serve as "trade goods" among miners. They are collected and traded by underground miners and they carry a high value.

Finally, prior research conducted by the team leader confirmed the importance of using credible insiders, e.g., coal hogs and those viewed as masters or experts, as spokespersons. Therefore, activities included in the newly developed training products focused on miners sharing personal experiences or stories regarding the specific content covered. In addition, actual miners were used as actors in the video that was developed, respecting the fact that they are the experts and hold the knowledge necessary to work safely. Using actual miners to communicate safety messages also helps to make the messages seem more credible to trainees. Because the video was not scripted, the miner-actors were allowed to tell their stories and provide their lessons in the "tribal language" commonly used and understood by coal miners. While most sites visited (eight of nine) had full multimedia capabilities, the safety trainers who collaborated with the team indicated that a combination of lecture, print, and video-based training materials would be most useful to them. Consequently a variety of products were created to meet different needs.

Social marketing implications

Research findings were used to develop a marketing plan or set of recommendations to guide new product development. This plan follows the common social marking model of the 4Ps (Niblett 2007):

Product

- Acknowledge and celebrate miners' pride in their skills and commitment to hard work.
- Design new products from the miners' point of view (use the miners themselves as credible messengers, use "tribal language," and tailor materials to the needs miners have expressed).

- Build on miners' recognition of the hazards associated with their work and their desire to:

  –Go home safely;

  –Know how to do tasks correctly and quickly; and

  –Keep themselves and others safe.

Pricing

- Ensure that training activities do not disrupt the flow of mining activities or slow production, and that they fit into the time generally allotted to safety training.
- Ensure that new products are technically accurate to address cultural and political costs (materials must be approved by technical experts and government agency sponsoring the research).
- Avoid social costs related to sensitivity of recent disaster (Darby Mine).

Placement

- Design training products to be used in necessary locations (training rooms, underground "lunchrooms").
- Assure that there are multimedia materials to fit a variety of training environments, from high-tech to no-tech.
- Distribute training materials using the following channels:

  –Regional and national coal and safety conferences;

  –A national web network of safety professionals;

  –The nine coal districts as defined by MSHA;

  –State and regional coal councils;

  –Journals, newspapers, and publications that target the coal industry;

  –The NIOSH website; and

  –Personal contacts made by research team members with industry.

Promotion

- Draw on the master–apprentice relationship and distrust of outsiders by using respected miners as spokespersons for delivering safety messages, and incorporate stories in training videos and print materials.

- Use miner's jargon, e.g., coal hog, in training materials instead of technical and legal terms.
- Create stickers that can be used as incentives for pretesting materials and participation in training activities.
- Use safety trainers as Technical Reviewers to assess accuracy, completeness, and useability of the materials in the kit. This also creates buy-in from trainers, who are the primary gatekeepers in whether new training products are used to train new miners or in Annual Refresher Training.
- Develop plan to market this new training product to relevant audiences (industry meetings, coal shows, etc.).

Training materials development and pretesting

Following these guidelines, the HC team developed a training toolkit and collateral audience-centered training materials to comprise the total intervention. This toolkit was based directly on safety trainers' and miners' preferences by combining a written curriculum with a safety training video in both DVD and VHS formats. For smaller mines or those lacking the capability for using video or computer-based training, the team also created a collection of "toolbox training modules" to be used in training small groups in 15 minutes or less. The specific need for this training medium was expressed by participants at small mines. For mines with multimedia capability, a video was produced as the primary training medium. Miners in three locations were asked to assist in its development. The video was loosely modeled after a popular TV show that chronicles blue-collar jobs. One of the NIOSH team members acted as the host of the video and interviewed miners, mechanics, and safety trainers at each mine. The individual miners led the "host" through the different steps required to perform flame cutting or welding activities safely underground. In all cases, the mechanics and miners in the video were encouraged to tell their story in their own words, and to explain how to execute cutting and welding tasks safely underground. They were also encouraged to share what would happen if things went wrong.

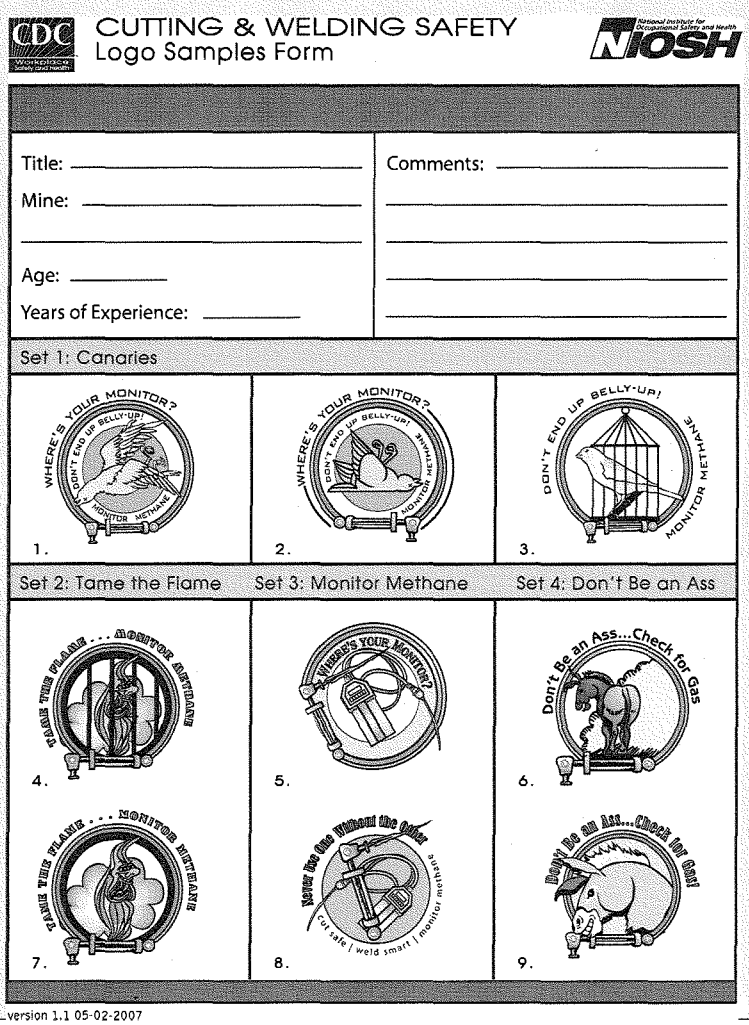
Additional components of the toolkit included:

- A curriculum booklet for trainers to use in New Miner Training, with details regarding the relevant regulations and hazards and suggested training activities;
- An electronic version of the curriculum in PowerPoint format;
- A short training presentation for Annual Refreshment Training including tips for trainers;

- A "tool-box training" booklet with short safety modules on various hazards associated with cutting and welding, modeled after prior NIOSH training research (Boldt, 2004);
- A safety awareness poster;
- A calendar including safety-tips revisited from the video; and
- Two separate reflective hardhat stickers.

FIGURE 5

Data Collection Sheet Used to Gauge Preferences among Miners and Safety Personnel Regarding Logo and Sticker Design



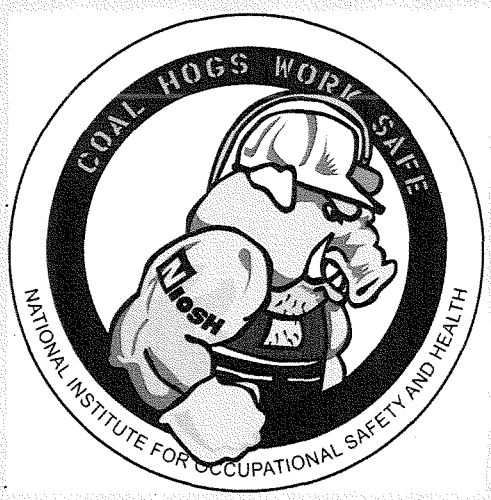
A variety of logos were designed for the project and pretested with the miners (Figure 5). When soliciting miners' feedback and preferences, it became clear that age was an important segmentation variable. One of the designs, for example, showed a dead canary in a cage, with the safety warning "Don't End Up Belly Up!" Although canaries have not been used to detect dangerous levels of gas in coal mines for decades, older miners easily understood the symbol's meaning. Younger workers, however, were unable to identify the significance of a dead bird or explain why it was under consideration as the logo for a safety project.

In keeping with their cultural practice of collecting stickers, one hard-hat sticker was developed featuring a muscular coal hog and the tag line "Coal Hogs Work Safe" (Figure 6). These stickers became a "golden ticket" for gaining access to miners for pretesting and other information. They loved them and were more than willing to trade their time and photograph for a sticker. Many miners negotiated for two or more stickers, bragging to their buddies that they were coal hogs and had the sticker to prove it.

Once a complete prototype of the training toolkit was developed, a series of external technical reviews was conducted. These reviews were completed on-site at mines or mine offices and in face-to-face meetings with content experts who were knowledgeable about flame cutting and welding, MSHA regulations, and policies related to training miners. Information was collected in a group setting

FIGURE 6

Coal Hog Sticker



through informal interviews with technical reviewers, as well as through questionnaires provided to each person. Efforts were made to gather input from all nine of the mines that participated in the initial ethnographic study, as well as from other safety specialists who could provide information on accuracy and completeness of the materials. Changes to the prototypes were made based on feedback received from these reviews.

Tame the Flame

Tame the Flame: Cutting and Welding Safety for Underground Coal Miners was selected as the name for the project. Eight different titles were brainstormed by the team, and each of the gatekeepers involved in the project (safety trainers at each mine) were asked to conduct a weighted vote to pick the winner. *Tame the Flame* refers to the behavior being promoted – to use proper protection and procedures when using flame cutting torches or welders underground. The *Tame the Flame* toolkit is currently undergoing final stages of technical review. Copies of the entire kit have been previewed by safety and management personnel from the mines that cooperated, as well as coal association members, engineers, and safety professionals from the coal regions. Modifications suggested by the reviewers have been incorporated into the kits and will be further modified based on feedback from the final review currently underway. *Tame the Flame* has been enthusiastically accepted by the coal mining industry professionals asked to review it. Their comments indicate that they perceive it as interesting, credible, comprehensive, and useful.

Conclusions and Future Research Topics

Safety awareness campaigns and social marketing have much in common. Neither will succeed if great care is not taken to identify and create relationships with the intended audience so that all products or solutions meet *their* needs, rather than the needs of the trainers, training developers, or market researchers. Ethnographies have been used for decades to increase knowledge of cultures, but there is great benefit in using this research method to inform the new development of effective occupational safety and health materials. The most valuable insight gained from this research project seems simple: that knowing the norms and values, the expected behaviors and the prohibited ones, the accepted tribal language, the heroes and credible spokesmen of an occupational culture are all key to developing effective training. Future evaluative research will help to determine whether or not this insight is valid.

Health communications or social marketing researchers should begin every project focused on identifying the needs of the audience to receive new training products. Future research could include expanded ethnographic study of miners' use and perception of existing training materials. Evaluation studies should also be conducted to assess the effectiveness of new training products. Finally, replication studies could be useful to determine if ethnographic and social marketing techniques are successful in the development of new training products for other occupational industries.

This "new product development" project, theoretically guided by social marketing, rapid assessment, adult learning, and the integrated SRL Safety Intervention Model, represents the unique challenges and success of mixed-methods research in the field of occupational safety and health. Future evaluation studies will be based on the upcoming release of the toolkit that the mining industry is eagerly awaiting. Meanwhile, insights may be gleaned from this work regarding team-based research and the use of social marketing strategies to ensure that new products are consumer-driven and audience-centered. The research team gained first-hand experience about the importance of engaging those who matter most in the process of developing new training materials – the miners.

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